Electrochemical Model Based Fault Diagnosis of Lithium Ion Batteries

Md Ashiqur Rahman[1]

Dr. Sohel Anwar[2]

Dr.Afshin Izadian[3]

1-Graduate Student, ME 2- Associate Professor, ME 3- Assistant Professor, ENT

Indiana University-Purdue University Indianapolis

Rechargeable Li-Ion battery used in Hybrid Electric Vehicle (HEV) operates under fluctuating current demands. During operation, battery can experience several conditions, i.e. overcharge, over discharge as well as degraded performance due to aging etc. Under these varying operating conditions, battery chemistry changes due to a change in different electrochemical properties. There can be situations (faults) when the parameter changes can be significant and may cause both performance degradation and physical damage. Due to the above reasons, a Battery Management System (BMS) that constantly monitors battery operating conditions and takes corrective actions when needed is necessary. Accurate and reliable fault detection is an integral part of an onboard BMS of any EV or HEV. We present an innovative approach to the fault detection of li-ion battery. Here we present an electrochemical model based fault diagnosis method via multiple model adaptive estimation (MMAE) technique for a li-ion battery. The observer used in this study is based on partial differential algebraic equation (PDAE). As the modeling is based on more realistic mathematical model of the battery chemistry, fault detection can be regarded as more reliable while compared with other available methodologies. The model was simulated under the real time battery load current profile, i.e. UDDS, US06 and HWFET etc. Simulation results show that, the proposed method of fault detection is accurate and reliable.